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The Motivation Factors in the Provision of Green Criteria in Green Building Development

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Abstract: Recently, green building has become globally vital especially in developed country such as United State, Europe, Australia, Hong Kong, Japan, Korea and Singapore. The Malaysian construction industry identified the necessity of green rating tool to improve building development in tropical climate. The Green Building Index (GBI) is Malaysia's industry recognised green rating tool for buildings to promote sustainability in the built environment and raise awareness of these issues among relevant stakeholders such as developers, architects, and contractors. This paper highlights motivation factors versus common criteria of green building in the provision of green building development. The assessment of commercial and residential properties under the GBI rating tool is based on six main criteria: energy efficiency, indoor environment quality, sustainable site planning and management, materials and resources, water efficiency and innovation. The data presented in this paper are mainly derived responses to a questionnaire that were completed by architects, engineers, urban planner, contractors and builders, developers and other consultants who is involved in green building development. For analysis, a statistical methods are used with Average Index portray the results. Accordingly, organisational motivation, social motivation, environmental motivation and economic motivation influenced the provision of green criteria. This paper finding leads the developer in decision making for common provision of green criteria in green building development.

Keywords: Motivation, Sustainable built environment, Criteria, Green Building Index.

1. Introduction

Buildings negatively impact people and the environment through the over consumptive use of natural resources and within the construction of most modern buildings about half of the energy used in the building construction and operation is expended in creating an artificial indoor climate in heating, cooling, ventilation, and lighting systems. Green building is the way to minimise the depletion of natural resources and deterioration of the environment. Green building is defined as a building that optimized performance in reducing the impact on human's health and the environment during the building lifecycle through the application of eco-concept in design, resources conservation, building component, construction method, maintenance, operation and removal. While Green building Index (GBI) is a green building assessment tools which are associated with the six major elements of green building design which are: Sustainable Site Design (SM); Water Conservation and Quality (WE); Energy Efficiency and

Environment (EE); Indoor Environmental Quality (EQ); Conservation of Materials and Resources (MR); and Green Technology Innovation (IN) (ACEM,2012). In general, previous studies show that there are several factors which may influence the decision making process to develop a green building project such as government, stakeholder's expectations, finance, compliance, technical knowledge, Assessment tools and methods (Alqaifi *et al.*, 2016).

2. Challenges Facing the Development of Green Building

Majority of experts, believe that the governments can effectively play a major role in promoting sustainable development such as green buildings (Samari *et al.*, 2013). At the same time, Governments can enforce the rules and regulations to support green building development. However, government policies and technical standards shall be adopted to satisfy the sustainable measures in order to avoid any issues that may result due to the conflict of

conditions of the construction site (Williams and Dair, 2007). Keiner (2006) pointed out that market base intensives are one of the most effective and efficient tools to address market failure together with non-market problems to improve the situation for green buildings development.

In England for example, Government has seen planning and construction practices as the main mechanisms by which to promote and deliver a sustainable built environment and government has proposed several of initiatives to ensure that sustainable development schemes are produced. Besides that, Different government offices are leading programs to create sustainable communities, reduce energy use in buildings, ensure sustainable building materials and methods are used and promote private sector interest in sustainable construction (Williams and Dair, 2007). In order to accelerate a shift to a more sustainable built environment and identified the need for a recognized code for sustainable buildings, further changes to planning and building regulations and better information and skills, as well as fiscal incentives for owners and occupiers of buildings, In fact, Many of these recommendations are now being actioned by government (Williams and Dair, 2007).

On the other hand, it has been stated that there are many several challenges and barriers that hinder the development of green buildings in Asia including Malaysia such as: Lack of awareness, Lack of knowledge and training programs about sustainable design, higher cost, special materials, rules and regulation, lack of demonstration, lack of technology and lack of demand (Shafii *et al.*, 2006).

In another study, it has been pointed out that wrong perception of transition and the expected return on investment represents the highest degree of barriers hindering the development of green buildings (Marker *et al.*, 2014). Whereas, it has been found out that lack of information and the lack of effective management of financial resources (Richardson and Lynes, 2007). In the same context, lack of financial support, professional experts and implementing of green technologies are considered to be a challenges in both public and private sector (Xiaolu, 2014).

From financial perspective, it is stated that green always costs more while no incentive regulatory in terms of code compliance to involve other alternative systems while limitation of materials availability is considered as a

challenge. Furthermore, any increase in time of construction means an additional cost due to the fact that time is money while the misunderstanding of green features by stakeholders presents another challenge (Griffin *et al.*, 2010).

In the same context , it has been stated that lack of scientific studies and insufficient contribution of institutional organization on green buildings present a challenge for decision makers (Kasai and Jabbour, 2014).

3. Motivation Factor

In making decision, motivation factors to embark on green building development are very crucial to developer. These factors of organizational, social, environmental and economic are main principles and very important to be considered. Thus it is a key driven to play a paramount role for developer to be involved in green building development. Through these motivation factors, developer should gain the benefits not only for them but also to the human being and environment.

4. Problem Statement and Research Lead

Malaysia, now is very intensive to build green building and together with other develop country promotes sustainable development. The current issue is the availability of guidelines and reference of assessment to green building is very limited. Malaysia Green Building Corporation (MGBC) has developing the Green Building Index (GBI) as a tool to assess the building for the green certification. However, there are few things are always ponder the developer to build green building. Why the developer has to embark or invest on green building development?; Do we/consultants are aware of green building and well verse about it?; and What are the benefits, opportunity and potential area in developing green building?

Based on the ambiguity on green building and question above, there is always a question to developer whether to embark and invest on green building development. What will motivate them to proceed with this development?; Does to develop green building is always influenced by higher initial cost? Therefore this paper aims to determine the motivation factor for the investor to proceed on green building development.

5. Research Methodology

The quantitative approach is applied to study and analyse the understanding of green building and determining which factors affecting most to the decision making of a green building development. Questionnaire was distributed by hand and emailed to the respondents who is involved in construction and development in Johor Bahru and Kuala Lumpur. The questionnaire survey conducted in this study was only distributed to the construction practitioner such as contractor, consultant, developer and government servant related construction in Johor Bahru and Kuala Lumpur only. The quantitative data provide an exploratory look at the views of a group of building professionals who are interested in or are actively practicing sustainable design or construction. However, the distribution method was not designed to achieve a random or representative sample, and the data were not meant to be subjected to tests of statistical significance. 69 questionnaires survey have been collected through professionals who are working with contractor, consultant, developer and government and been involved in buildings development sector in Malaysia. Collected data for this study was analysed using SPSS Inc. Ver.22 and Microsoft Excel 2010 software. Interpretations of results were then carried out.

By using Microsoft Excel 2015 and SPSS Ver.16, it simplified the calculation of average Average Index and easy to generate chart and graph. The average index is calculated based on equation as follows (Al-Hammad and Sadi Assaf, 1996),

Average Index Formula:

$$\text{Average Index} = \frac{\sum \alpha_i x_i}{\sum x_i} \quad (1)$$

Where,

α_i = constant expressing the weight given to i
 x_i = the frequency of the response for $i = 1, 2, 3, 4$, and illustrated as follows:

x_1 = frequency of the 'extremely not important' response and corresponding to $\alpha_1 = 1$, x_2 = frequency of the 'not important' response corresponding to $\alpha_2 = 2$, x_3 = frequency of the 'moderately important' response corresponding to $\alpha_3 = 3$, x_4 = frequency of the 'very important' response corresponding to $\alpha_4 = 4$, x_5 = frequency of the 'extremely important' response corresponding to $\alpha_5 = 5$,

The answering technique used is based on

Likert Scale which is divided into five scale rating categories. By referring to Majid and McCaffer (1997), the rating scales used for the questionnaires in this study are as follows:

Table 1: Rating Scales of Average Index

Rating	Rating Scale	Classification
1	Very low or extremely disagreed	$1.00 \leq$ Average Index score < 1.50
2	Low or disagreed	$1.50 \leq$ Average Index score < 2.50
3	Medium or moderately agreed	$2.50 \leq$ Average Index score < 3.50
4	High or very agreed	$3.50 \leq$ Average Index score < 4.50
5	Very high or extremely agreed	$4.50 \leq$ Average Index score ≤ 5.00

6. Respondent Background

The questionnaire survey obtained the demographic information of the respondents which have working experiences with distributions 13%(9) of respondents had more than 21 years of working experience, 11.6%(8) have between 16-20 years of working experience, While another 23.2%(16) have between 11-15 years of working experience and another 15.9%(11) have between 6-10 years of working experience. In majority 36.2%(25) had 1-5 years of working experience.

For respondent working sector 21.75(15) are from consultants, 24.6%(17) are from contractor, 40.6%(28) are form developers and 13%(9) are from government related construction working sector.

7. Motivational Factors in Provision of Green Criteria in Green Buildings Development

This section attempts to figure out the respondent's opinion related to four factors of organisational motivator, social motivators, environmental motivator and economic motivator.

7.1 Respondents Opinion Related to Organizational Motivators

Table 2 shows the result of the respondent's opinion related to organizational motivators and the agreement percentages of respondents on organizational motivators.

Table 2: Agreement of Respondents on Organisational Motivators

Organizational Motivators	Average Index	Rank
Green buildings lead to develop new, more energy-efficient products and services to expand sales.	4.217	1
As proof that the developers have met environmental standards and performance.	4.188	2
Green buildings provide additional value on marketing and advertising work of the company.	4.145	3
Green buildings provide developer companies to take new projects by creating value within the compatible market.	4.058	4
Green Buildings enhance competitiveness and to mark achievement in industry	4.014	5
Green Buildings demonstrate corporate social responsibility of the company	4.000	6
Green construction as a safe way to avoid any risk of non-compliance in development	3.449	7

Table 2 shows the result of the respondent's opinion related to organizational motivators and the agreement percentages of respondents on organizational motivators. From the results, the most three prominent factor identified by respondent are *Green buildings lead to develop new, more energy-efficient products and services to expand sales, As proof that the developers have met environmental standards and performance and Green buildings provide additional value on marketing and advertising work of the company* are seen as the most crucial organizational motivators for making green buildings more attractive.

The burgeoning green building scene introduces new opportunities for building

materials manufacturers and building professionals. Sectors which tackle energy efficiency and reduce energy loss are likely to lead the demand. The use of solar water heater, LED bulb, inverter washing machine, refrigerator and especially air condition become demanding. In tropical Malaysia where air conditioning remains the biggest load on building energy requirements, small percentage improvements in HVAC efficiency and building envelope effectiveness can translate to significant costs savings. Designing systems with the local conditions in mind and reducing sharp angles in piping systems can improve fluid dynamics in HVAC systems, hence, reducing energy wastage.

Opportunities in energy consulting of new and retrofit buildings are likely to improve. Solar photo voltaic technology is relevant for the Malaysian climate, though the current price and its long payback period is a deterrent; the potential of using renewable energy to reduce energy consumption from the grid is high. Nowadays, with the rising of energy cost especially the electricity tariff by Tenaga Nasional Berhad (TNB) leads the awareness of energy efficiency to most of end user in Malaysia. To overcome this issue, they are trying to cut down or minimise the electricity bill as much as possible or choose to buy or purchase those more energy efficiency product. This is an opportunity to market especially for developer to develop more energy efficiency product to cater the rising demands or to use low energy consumption equipment in their development.

For developer, investing in green building development and get GBI certification for their development is the way to demonstrate their achievement and as a proof that they have meet environmental standards and performance in green building. Green building also provides additional value on marketing and advertising of the company by having this certification and recognition from GBI for having green building development.

7.2 Respondents Opinion Related to Social Motivators

Table 3 shows the result of the respondent's opinion related to social motivators and the agreement percentages of respondents on social motivators.

Table 3: Agreement of Respondents on Social Motivators

Social Motivators	Average Index	Rank
Green buildings enhance health for building occupants due to improved indoor quality	4.087	1
Green buildings improve comfort, satisfaction and well-being of building occupants	3.957	2
Green buildings improve the quality of life for individuals	3.884	3
Green building enhance social support and sense of community	3.797	4
Green buildings increase the occupant safety and security	3.606	5

Table 3 shows the result of the respondent's opinion related to social motivators and the agreement percentages of respondents on social motivators. From the results, the most three prominent factor identified by respondent are *Green buildings enhance health for building occupants due to improved indoor quality*, *Green buildings improve comfort, satisfaction and well-being of building occupants* and *Green buildings improve the quality of life for individuals* are seen as the most crucial social motivators for making green buildings more attractive.

Based on result shows in Table 3, with the Average Index of 4.087 and 81.20% of the respondent agreed that green buildings provide better health for building occupants due to improved indoor quality. Green building provides substantial health benefits to occupants due to improved indoor environment quality (EQ) which may be associated to GBI credits. For each one of us actually spends most of our time indoors and we are exposed to environment which may affect our psychological and physical well-being. Many architects and industry professionals are working to change traditional construction practices. They are adopting more sustainable approaches to design which involves more recycled content products, products with low volatile organic compounds (VOCs) such as adhesives and paints, and the use of natural heating and ventilation systems to name a few. Using low to no VOC products helps to promote better indoor environment quality or EQ and a

healthy environment for building occupants. Healthy air quality can impact the building occupant comfort and health.

As refer to Table 3, more than 75% of the respondent agreed that Green buildings improve comfort, satisfaction and well-being of building occupants. Malaysia climate is hot and humid, thus green building is important to balance up and improved the comfortable level of the building occupier (Md Din et al, 2014). Hence, it was very common to perceive that most of the residential in Malaysia are fitted out with air conditioning in order to achieve optimum Indoor Environmental Quality (Khalil and Husin, 2009). Despite the fact that the buildings are well equipped with HVAC systems, occupants still exposed to risks from having Sick Building Syndrome which symptoms are headache, mental fatigue, nausea, airway infections, wheezing, and itchiness to skin (Bluyssen, 2009). Problem arises when the poor indoor environmental circumstances may lead to low levels of work productivity amongst the occupants (Khalil and Husin, 2009).

The social benefits of green building are related to improvements in the quality of life, health, and well-being. As refer to Table 3, the Average Index of 3.884 and with more than 68% of respondents agreed that Green buildings improve the quality of life for individuals. The occupants can enjoyed the benefit of green building in term of health, comfort and satisfaction. The building environment can have both negative and positive impacts on the occupants' quality of life. Negative impacts include illness, absenteeism, fatigue, discomfort, stress, and distractions resulting from poor indoor air quality, thermal conditioning, lighting, and specific aspects of interior space design (e.g., materials selections, furnishings, and personnel densities). Reducing these problems through sustainable design often improves health and performance. Improved indoor air quality and increased personal control of temperatures and ventilation have strong positive effects. In addition to reducing risks and discomforts, buildings should also contain features and attributes that create positive psychological and social experiences. Although less research has been done on health-promoting environments, emerging evidence shows that certain sustainable building features, including increased personal control over indoor environmental conditions, access to daylight

and views, and connection to nature, are likely to generate positive states of well-being and health.

7.3 Respondents Opinion Related to Environmental Motivators

Table 4 shows the result of the respondent's opinion related to environmental motivators and the agreement percentages of respondents on environmental motivators.

Table 4: Agreement of Respondents on Environmental Motivators

Environmental Motivators	Average Index	Rank
Green buildings improve air, thermal, daylight and acoustic environments	4.203	1
Green Buildings lower air pollutant and greenhouse gas emissions	4.116	2
Green Buildings lead to decrease use of natural resources and lower ecosystem impacts	4.101	3
Green building reduced volumes of solid waste	4.000	4

As refer to Table 4 above, the result show the Average Index is 4.203 and almost 89% of respondents agreed that the *green building gives improvement to indoor and outdoor environment quality*. This result indicates the growing public awareness of the risks associated with poor indoor air quality in the workplace and the home. Green building also supports the control of climate change.

In cities the "heat island effect" is a result of the radiation balances in urban areas affect the temperature distribution. Solar radiation is absorbed and transformed into heat. "Pavements, walls and roofs store heat and emit long wave radiation to the sky" (United Nations Human Settlement Program, 2008:127). The city takes much longer to cool off than the surrounding vegetated areas. Vegetated areas take longer to cool because the sun causes water held in soil and leaves to evaporate, and shading of the plants keep the ground cool. The urban areas have higher temperatures than surrounding rural areas. This phenomenon is known as the "heat island" effect (United

Nations Human Settlement Program, 2008). According to Mckinstry, green building is a way to attempt the dilemma of global climate change on a local urban level (Mckinstry, 2004; Codiga, 2008). As show in Table 3, 84% of respondent agreed with this statement and the Average Index is 4.116. For example, an apartment building with a green roof helps to mitigate the urban heat island effect and reduces the added energy demands to keep buildings cool and offers water management. A green roof can reduce water runoff and sewer overflows (USGBC, 2008). Nowadays in Malaysia, green roof became more popular and highly demand for a new life style. With a nice soft and hard landscape at roof level, the occupant or resident of the building can enjoy their life and having outdoor activity at this place.

7.4 Respondents Opinion Related to Economic Motivators

Table 5 shows the result of the respondent's opinion related to economic motivators and the agreement percentages of respondents on economic motivators.

As can be seen in Table 5, 88.4% of respondents agreed that the upfront cost increased in green buildings is often offset by a decrease in long-term life cycle costs. While there is a common perception that green buildings cost a heavy premium over normal buildings, industry experts from past research have highlighted that it is very much possible to complete green developments with minimal additional cost. In the study case of two apartment project, the developers spend in the range of 4% to 7% of the total construction cost for green building. According to Zhang et al. (2010), provisional of green building criteria providing the reduction of operation and maintenance cost. The reduction cost can be achieved through lower annual energy cost, lower annual water cost and increased profitability of company with improved productivity. This cost reduction were identified as main economic motivational factors for green building development and construction.

Table 5: Agreement of Respondents on

Economic Motivators

Economic Motivators	Average Index	Rank
Upfront cost increases in green buildings are often offset by a decrease in long-term life cycle costs	4.362	1
Higher upfront capital costs for green buildings have been found to be proportional to the increased level of environmental certification	4.145	2
Green building is new way of life, high possibility to tap into new market and highly demand	4.014	3
Green buildings reduce energy costs from heating, cooling, lighting and ventilation	3.957	4
Financial incentives can be obtained through tax exemption, fee waiver and loans	3.884	5
Special features of green building will attract more buyers	3.870	6
An increase in capital cost is marginal when the concept is being introduced early in the project life cycle	3.812	7
Green buildings reduced water consumption	3.768	8
Fuel or transportations costs are lower	3.710	9
Waste disposal costs of green buildings are lower	3.696	10
Green buildings provide higher return on investment	3.608	11
Maintenance and repair costs of green buildings are lower	3.391	12

Refer to Table 5, more than 84% of respondent agree that higher upfront capital costs for green buildings have been found to be proportional to the increased level of environmental certification. However, more and

more projects recently are able to achieve higher levels of certification at lower cost compared to less ambitious projects. With more awareness, demands and taking up rates on green building, the cost are now reducing as the technology are more advance and increased volume in term of material demands.

As shows in Table 5, the Average Index is 4.014 and 81.1% of respondents are agreed that Green building is new way of life, high possibility to tap into new market and highly demand. The economic focus is in sustaining the capital that makes up our social structure and creating new markets and opportunities for business. Potential savings from more efficient green buildings can also decrease operating expenses throughout the life cycle of buildings. Green projects undertaken by competent project management teams can increase the Net Present Value (NPV) of such developments. Nowadays, high performance green buildings become a trend and lifestyle to some people. The roof top landscaping together with other facilities such as playground area for children, indoor and outdoor gym, swimming pool, barbeque area, spa and Jacuzzi etc. are now become one of important selling points to the developer. The provision of green criteria such as LED light, motion sensor detection, rain water harvesting, automatic dripping system, photovoltaic solar panel and many other offers great saving to the building occupants or tenant in term of maintenance and recurring cost.

CONCLUSION

Based on survey, 69 respondents respond to questionnaire survey. The respondents surveyed represents a broad spectrum of different professions including architects, civil engineers, quantity surveyor, electrical engineers, mechanical engineer, site supervisor, quality manager and QAQC Engineer, project manager, project executive, assistant engineer and respectively from other professions, such as general manager, assistant manager, horticulturist, landscape architect and M&E supervisor. Most of the respondents are working with Developer, Contractor and Consultant who had experienced in construction and development industries. This shows that respondents are involved in construction and development thus their opinion in this research is consider important.

The conclusions that can be drawn from this

study are the motivation factors in this case study is divided into four categories, Organizational, Social, Environmental and Economic. From the study, it can conclude that there are a relationship between motivation factors and common provision of green building. The relationship between this motivation factors and green building criteria are:

- Organizational motivation factors are related to the overall green building criteria including EE, EQ, SM, MR, WE and IN.
- Social motivation factors are related to air quality, lighting, visual and acoustic comfort, site planning and transport.
- Environmental motivation factors are related to EE, SM, MR and WE.
- Economic motivation factors are related to EE, EQ, MR, WE and IN.

This study was covered on motivation factors and the provision criteria of green building in general.

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